**Enzyme action and factors that affect enzyme activity**

Aims

1. To observe the action of the enzyme catalase.
2. To demonstrate the effect of pH and temperature on catalase activity.
3. The enzyme catalase breaks down hydrogen peroxide into water and oxygen. Hydrogen peroxide is produced as a by-product of chemical reactions and must be quickly broken down because it is very toxic.

Equipment

* 7 test-tubes Pestle and mortar
* Beaker Manganese dioxide powder
* Fresh liver Fine sand
* Splints, toothpick or tapers Distilled water
* Fresh hydrogen peroxide solutions (1% and 3%)

Method

Prepare and label the following seven test-tubes as indicated below. After each tube has been set up, observe what is occurring and record your results in a table. Assess the reaction as – for no reaction, + for slight reaction, ++ for moderate reaction and +++ for very reactive. If gas is given off, check if it will rekindle a glowing splint.

Tube A 3% hydrogen peroxide solution to a depth of 2 cm

Tube B a very small amount of manganese dioxide plus 3% hydrogen peroxide solution to a depth of 2 cm

Tube C 1g of sand plus 3% hydrogen peroxide solution to a depth of 2 cm

Tube D a cube of liver, 1 cm3, plus 3% hydrogen peroxide solution to a depth of 2 cm

Tube E a cube of liver, 1 cm3, plus 1% hydrogen peroxide solution to a depth of 2 cm

Tube F a cube of liver, 1 cm3, that has been ground in a mortar and pestle with 1g of sand, plus 3% hydrogen peroxide solution to a depth of 2 cm

Tube G a cube of liver, 1cm3, that has been in boiling water in a beaker for 3 minutes and then allowed to cool to room temperature, plus 3% hydrogen peroxide solution to a depth of 2 cm

Interpretation of data

1. What was the purpose of tube A?
2. Identify the gas that was given off from the mixture of hydrogen peroxide and manganese dioxide.
3. What was the purpose of setting up tube B?
4. Why was sand added when grinding up the liver?
5. What was the purpose of tube C?
6. Discuss the similarities and differences between the ground liver-hydrogen peroxide and unground liver-hydrogen peroxide reactions.
7. What effect did boiling have on oxygen release?
8. Discuss the similarities and differences between tubes D and E.
9. Which test tubes could be compared to show the effects of: increasing surface area, changing concentration of substrate and the effect of heat on enzyme action? Justify your answers.